

WHAT IS CLAIMED IS:

1. A data transmission method for sequentially transmitting data in units of packets each containing transmission data, from the transmitting end to the receiving end, said method comprising:

    a transmission-side process of transmitting an uncompressed packet in which predetermined transmission data is stored as uncompressed data, and then continuously transmitting a compressed packet in which at least a portion of transmission data following the predetermined transmission data is compressed and stored as compressed data;

    a reception-side process of receiving the packets transmitted from the transmitting end, and restoring the transmission data of the respective packets on the basis of the uncompressed data and the compressed data stored in the respective packets;

    said transmission-side process including a compression process of forming compressed data to be stored in a compressed packet to be transmitted, on the basis of the transmission data of a reference packet that is the uncompressed packet and the transmission data of the compressed packet to be transmitted; and

    said reception-side process including a restoration process of restoring the transmission data of a compressed packet to be restored, on the basis of the transmission data of the reference packet and the compressed data included in the compressed packet to be restored.

2. The data transmission method of Claim 1 wherein:

in said transmission-side process, as said uncompressed packet, a packet including the uncompressed data and a packet identifier indicating this packet is transmitted, and as the compressed packet that follows the uncompressed packet, a packet including the compressed data and a reference packet identifier indicating the uncompressed packet as a reference packet is transmitted; and

in said compression process, as said compressed data, difference data between the transmission data of the reference packet and the transmission data of the compressed packet is formed.

3. The data transmission method of Claim 2 wherein:

in said transmission-side process, additional information for calculating the difference data on the basis of the transmission data of the reference packet is stored; and

in the reception-side process, the difference data in the compressed packet is calculated from the transmission data of the reference packet, on the basis of the additional information stored in the compressed packet.

4. The data transmission method of Claim 3 wherein said additional information is a sequence number which indicates how many packets have been transmitted before the compressed packet,

after transmission of the uncompressed packet.

5. The data transmission method of Claim 3 wherein said additional information is a variable of a calculation formula for calculating the difference data of the compressed packet from the transmission data of the reference packet.

6. The data transmission method of Claim 2 wherein:

in the transmission-side process, a plurality of uncompressed packets which have been formed so as to be transmitted prior to the compressed packet are used as reference packets, and difference data between the transmission data of each reference packet and the transmission data of the compressed packet is associated with the reference packet identifier corresponding to each reference packet, and plural sets of associated difference data and reference packet identifiers are stored in the compressed packet as the compressed data; and

in the reception-side process, the transmission data of the compressed packet is restored using any set of different data and packet identifier stored in the compressed packet.

7. The data transmission method of Claim 1 wherein, in the transmission-side process, said uncompressed packet is transmitted at regular intervals.

8. The data transmission method of Claim 1 wherein, in the transmission-side process, said uncompressed packet is transmitted when the size of the compressed data included in the compressed packet to be transmitted to the receiving end exceeds a predetermined value.

9. The data transmission method of Claim 1 wherein:

in the reception-side process, a request for transmission of the uncompressed packet is output to the transmitting end when the size of the compressed data included in the compressed packet supplied from the transmitting end exceeds a predetermined value; and

in the transmission-side process, on receipt of the request from the receiving end, the uncompressed packet is transmitted to the receiving end.

10. The data transmission method of Claim 1 wherein, in the transmission-side process, the uncompressed packet containing the same transmission data is continuously transmitted by a predetermined number of times to the receiving end.

11. The data transmission method of Claim 10 wherein:

in the reception-side process, when a restoration error of the compressed data stored in the compressed packet is detected, this restoration error is notified to the transmitting end; and

in the transmission-side process, the number of times that the uncompressed packet is transmitted to the receiving end is changed on the basis of the frequency of notification of restoration error from the receiving end.

12. The data transmission method of Claim 1 wherein, in the transmission-side process, after transmission of the uncompressed packet, an auxiliary transmission packet including the packet identifier and the transmission data stored in the uncompressed packet is transmitted by a predetermined number of times to the receiving end.

13. The data transmission method of Claim 1 wherein:

in the transmission-side process, the uncompressed packet, to which an error correction code is added, is transmitted to the receiving end; and

in the reception-side process, the uncompressed packet is subjected to error correction according to the error correction code.

14. The data transmission method of Claim 2 wherein:

in the transmission-side process, error correction codes are added to the packet identifier and the transmission data which are stored in the uncompressed packet; and

in the reception-side process, the packet identifier and the

transmission data included in the uncompressed packet are subjected to error correction according to the error correction codes.

15. The data transmission method of Claim 1 wherein:

in the reception-side process, when a restoration error of the compressed data stored in the compressed packet is detected, this restoration error is notified to the transmitting end; and

in the transmission-side process, according to the frequency of notification of restoration error from the receiving end, one of the following two processes is performed: a process of transmitting the uncompressed packet after attaching an error correction code to this packet, and a process of transmitting the uncompressed packet without attaching an error correction code to this packet.

16. The data transmission method of Claim 1 wherein:

in the transmission-side process, only the uncompressed packet is stored as data to be retransmitted in a buffer for retransmission;

in the reception-side process, when a transmission error of the uncompressed packet is detected, a request for retransmission of the uncompressed packet as the error packet is output to the transmitting end; and

in the transmission-side process, on receipt of the request

for retransmission, the uncompressed packet corresponding to the error packet is retransmitted to the receiving end only when the uncompressed packet is stored in the buffer.

17. The data transmission method of Claim 2 wherein:

in the transmission-side process, the packet identifier and the transmission data which are included in the uncompressed packet are stored as data to be retransmitted in a buffer for retransmission;

in the reception-side process, when a transmission error of the uncompressed packet is detected, a request for retransmission of the packet identifier and the transmission data stored in the uncompressed packet as the error packet is output to the transmitting end; and

in the transmission-side process, on receipt of the request for retransmission, the packet identifier and the transmission data stored in the uncompressed packet as the error packet are retransmitted to the receiving end only when these are stored in the buffer.

18. A data transmission method for sequentially transmitting data in units of packets each containing transmission data, from the transmitting end to the receiving end, said method comprising a first data transmission process and a second data transmission process,

said first data transmission process including:

a transmission-side process of transmitting an uncompressed packet in which predetermined transmission data is stored as uncompressed data, and then continuously transmitting a compressed packet in which at least a portion of transmission data following the predetermined transmission data is compressed and stored as compressed data;

a reception-side process of receiving the packets transmitted from the transmitting end, and restoring the transmission data of the respective packets on the basis of the uncompressed data and the compressed data stored in the respective packets;

said transmission-side process including a compression process of forming compressed data to be stored in a compressed packet to be transmitted, on the basis of the transmission data of a reference packet that is the uncompressed packet, and the transmission data of the compressed packet to be transmitted; and

said reception-side process including a restoration process of restoring the transmission data of a compressed packet to be restored, on the basis of the transmission data of the reference packet, and the compressed data included in the compressed packet to be restored; and

said second data transmission process for forming, at the transmitting end, compressed data to be stored in the compressed packet by a formation method different from the compressed data

formation method employed in the first data transmission process, and restoring, at the receiving end, the compressed data stored in the compressed packet by a restoration method different from the compressed data restoration method employed in the first data transmission process;

wherein, when transmitting the transmission data in packet units, the data transmission process is switched between the first process and the second process according to whether or not a restoration error occurs in the compressed packet at the receiving end.

19. The data transmission method of Claim 18, wherein said second data transmission process includes:

as a transmission-side process, a compression process of forming compressed data to be stored in a compressed packet to be transmitted, on the basis of the transmission data of a previous packet which has been transmitted immediately before the compressed packet, and the transmission data of the compressed packet to be transmitted; and

as a reception-side process, a restoration process of restoring the compressed data included in a compressed packet to be restored, by using the transmission data of the previous packet.

20. The data transmission method of Claim 19 wherein:

at the receiving end, when an error occurs in the restoration process of restoring the compressed data included in the compressed packet, the receiving end notifies the transmitting end of this error;

at the transmitting end, when the frequency of error notification exceeds a predetermined value, the transmitting end requests the receiving end to change the restoration process at the receiving end to the restoration process in the first data transmission process and, thereafter, the transmitting end performs the compression process in the first data transmission process; and

on the other hand, when the frequency of error notification becomes equal to or smaller than the predetermined value, the transmitting end requests the receiving end to change the restoration process at the receiving end to the restoration process in the second transmission process and, thereafter, the transmitting end performs the compression process in the second data transmission process.

21. The data transmission method of Claim 19 wherein:

at the receiving end, when the frequency of error which occurs in the restoration process of restoring the compressed data included in the compressed packet exceeds a predetermined value, the receiving end requests the transmitting end to change the compression process at the transmitting end to the

compression process in the first data transmission process;

on the other hand, when the frequency of error in the restoration process becomes equal to or lower than the predetermined value, the receiving end requests the transmitting end to change the compression process at the transmitting end to the compression process in the second data transmission process; and

the transmitting end performs either the compression process in the first data transmission process or the compression process in the second data transmission process, according to the request from the receiving end.

22. A data transmission method for sequentially transmitting data in units of packets each containing transmission data, from the transmitting end to the receiving end, said method comprising:

a transmission-side process of transmitting an uncompressed packet in which predetermined transmission data is stored as uncompressed data, and then continuously transmitting a compressed packet in which at least a portion of transmission data following the predetermined transmission data is compressed and stored as compressed data; and

a reception-side process of receiving the packets from the transmitting end, and restoring the transmission data of the respective packets on the basis of the uncompressed data and the

compressed data stored in the respective packets;

    said transmission-side process including:

        a compression process of forming compressed data to be stored in a compressed packet to be transmitted, on the basis of updation information relating to a packet which has been transmitted prior to the compressed packet and the transmission data of the compressed packet to be transmitted, and

        a transmission-side updation process of setting information relating to the uncompressed packet as an initial value of the updation information, and updating the updation information to information relating to a specific compressed packet every time the specific compressed packet is formed; and

    said reception-side process including;

        a restoration process of restoring the transmission data of a compressed packet to be restored by using updation information relating to a packet which has been received prior to the compressed packet, and

        a reception-side updation process of setting information relating to the uncompressed packet as an initial value of the updation information and, thereafter, updating the updation information to information relating to the specific compressed packet every time the transmission data of the specific compressed packet is restored.

23. The data transmission method of Claim 22 wherein:

said updation information is composed of a reference packet identifier which indicates, as a reference packet, either the uncompressed packet or the specific compressed packet, and the transmission data corresponding to the reference packet;

    said compressed packet includes a reference packet identifier which indicate, as a reference packet, either the uncompressed packet or the specific compressed packet, and an information updation flag indicating whether the updation information is to be updated or not;

    the information updation flag included in the specific compressed packet is set at a value indicating that the updation information is to be updated; and

    the information updation flags included in compressed packets other than the specific compressed packet are set at a value indicating that the updation information is not to be updated.

24. The data transmission method of Claim 22 wherein, in the transmission-side process, the specific compressed packet is transmitted to the receiving end every time a predetermined period of time has passed.

25. The data transmission method of Claim 22 wherein, in the transmission-side process, the specific compressed packet is transmitted to the receiving end every time a predetermined

number of compressed packets have been transmitted.

26. The data transmission method of Claim 22 wherein, in the transmission-side process, the specific compressed packet is transmitted to the receiving end when transmission of the specific compressed packet is requested from the receiving end.

27. The data transmission method of Claim 22 wherein, in the transmission-side process, the specific compressed packet is transmitted when the size of the compressed data included in the compressed packet to be transmitted to the receiving end exceeds a predetermined value.

28. The data transmission method of Claim 22 wherein, in the transmission-side process, the specific compressed packet is transmitted when the average of sizes of the compressed data included in the compressed packets to be transmitted to the receiving end exceeds a predetermined value.

29. The data transmission method of Claim 22 wherein:

    said transmission data includes plural pieces of item-basis transmission data corresponding to different items;

    said compressed data includes plural pieces of item-basis compressed data corresponding different items;

    the item-basis compressed data corresponding to each item in

the compressed data included in the compressed packet is obtained by compressing the item-basis compressed data corresponding to each item in the transmission data of the compressed packet by using the item-basis transmission data corresponding to each item in the transmission data of the uncompressed packet or the specific compressed packet; and

each of the item-basis compressed data includes an item type flag which specifies the item corresponding to the compressed data.

30. The data transmission method of Claim 29 wherein each of the item-basis compressed data includes data length information indicating the length of the compressed data.

31. The data transmission method of Claim 29 wherein:

the respective item-basis compressed data are formed using different compression methods; and

each of the item-basis compressed data includes a restoration method information which indicates a restoration method corresponding to the compression method.

32. A data transmission apparatus for sequentially transmitting data in units of packets each containing transmission data, to the receiving end, comprising:

a reception unit for receiving the transmission data as an

input signal;

a packet formation unit for receiving the transmission data received, and forming an uncompressed packet in which predetermined transmission data is stored as uncompressed data, and a compressed packet in which at least a portion of transmission data that follows the predetermined transmission data is compressed and stored as compressed data;

a reference information management unit for holding and managing, as reference information, information relating to the uncompressed packet formed by the packet formation unit;

a transmission unit for transmitting the respective packets formed by the packet formation unit, as a transmission signal, to the receiving end; and

said packet formation unit forming compressed data to be stored in a compressed packet to be formed, on the basis of the transmission data of the uncompressed packet and the reference information stored in the reference information management unit.

33. A data reception apparatus for receiving data which have been transmitted in packet units from the transmitting end as a transmission signal, and sequentially restoring transmission data of the respective packets, comprising:

a packet reception unit for receiving the transmission signal, and outputting an uncompressed packet in which predetermined transmission data is stored as uncompressed data,

and a compressed packet in which at least a portion of transmission data following the predetermined transmission data is compressed and stored as compressed data;

a packet restoration unit for receiving the output from the packet reception unit, and restoring the respective packets on the basis of the data stored in the respective packets, and outputting the transmission data of the respective packets;

an output unit for outputting the transmission data of the respective packets supplied from the packet restoration unit; and

said packet restoration unit restoring the transmission data of the compressed packet, on the basis of the compressed data included in the compressed packet and the reference information stored in the reference information management unit.

34. A data transmission apparatus for sequentially transmitting data in units of packets each containing transmission data, to the receiving end, comprising:

a reception unit for receiving the transmission data as an input signal;

a packet formation unit for receiving the transmission data, and forming an uncompressed packet in which predetermined transmission data is stored as uncompressed data, and a compressed packet in which at least a portion of transmission data following the predetermined transmission data is compressed and stored as compressed data;

an information management unit for managing, as updation information, information relating to the uncompressed packet and a specific compressed packet which are formed by the packet formation unit;

a transmission unit for transmitting the packets formed by the packet formation unit as a transmission signal to the receiving end;

said information management unit being constructed so that it sets information relating to the uncompressed packet as an initial value of the updation information and, thereafter, updates the updation information to the information relating to the specific compressed packet every time the specific compressed packet is formed; and

said packet formation unit being constructed so that it forms the compressed data to be stored in a compressed packet to be formed, on the basis of the transmission data of the compressed packet and the updation information stored in the reference information management unit.

35. A data reception apparatus for receiving data which have been transmitted in packet units from the transmitting end as a transmission signal, and sequentially restoring transmission data of the respective packets, comprising:

a packet reception unit for receiving the transmission signal, and outputting an uncompressed packet in which predetermined

transmission data is stored as uncompressed data, and a compressed packet in which at least a portion of transmission data following the predetermined transmission data is compressed and stored as compressed data;

a packet restoration unit for receiving the output from the packet reception unit, and restoring the respective packets on the basis of the data stored in the respective packets, and outputting the transmission data of the respective packets;

a reference information management unit for storing and managing, as reference information, information relating to the uncompressed packet and the specific compressed packet which are restored by the packet restoration unit;

an output unit for outputting the transmission data of the respective packets which are restored by the packet restoration unit;

said information management unit being constructed so that it sets the information relating to the uncompressed packet as an initial value of the updation information and, thereafter, updates the updation information to the information relating to the specific compressed packet every time the specific compressed packet is restored; and

said packet restoration unit being constructed so that it restores the transmission data of the compressed packet, on the basis of the compressed data included in the compressed packet and the reference information stored in the reference information

management unit.

36. A data structure of a compressed packet which includes compressed data obtained by compressing at least a portion of transmission data and is to be transmitted after a reference packet which is used for restoration of the compressed data, said compressed packet comprising:

a data section in which the compressed data is stored; and a header section including a first identifier which indicates whether the data stored in the data section is compressed or not, and a second identifier which identifies the reference packet.

37. The packet data structure of Claim 36 wherein:

the transmission data comprises plural pieces of item-basis compression target data corresponding to difference items to be compressed, and non-target data which is not to be compressed;

the data section of the compressed packet includes, as the compressed data, item-basis compressed data corresponding to the respective items, and the non-target data;

the item-basis compressed data corresponding to each item is restorable on the basis of item-basis uncompressed data corresponding to each item and stored in the reference packet; and

the header section of the compressed packet includes

additional information for calculating the item-basis compressed data corresponding to a predetermined target item, on the basis of the corresponding item-basis uncompressed data in the reference packet.

38. A data structure of a compressed packet which includes compressed data obtained by compressing at least a portion of transmission data and is to be transmitted after a reference packet which is used for restoration of the compressed data, said compressed packet comprising:

a data section in which the compressed data is stored; and

a header section including a first identifier which indicates whether the data stored in the data section is compressed or not, a second identifier which identifies the reference packet, and a reference information updation flag which indicates whether reference information corresponding to the transmission data of the reference packet is to be updated or not.

39. The packet data structure of Claim 38 wherein:

the transmission data comprises plural pieces of item-basis compression target data corresponding to difference items to be compressed, and non-target data which is not to be compressed;

the data section of the compressed packet includes, as the compressed data, item-basis compressed data corresponding to the respective items, and the non-target data;

the item-basis compressed data corresponding to each item is restorable on the basis of item-basis uncompressed data corresponding to each item and stored in the reference packet; and

the header section of the compressed packet includes additional information for calculating the item-basis compressed data corresponding to a predetermined target item, on the basis of the corresponding item-basis uncompressed data in the reference packet.

40. The packet data structure of Claim 39 wherein the header section of the compressed packet includes a data existence flag which indicates whether or not any of the plural item-basis compressed data is included in the data section of the compressed packet.